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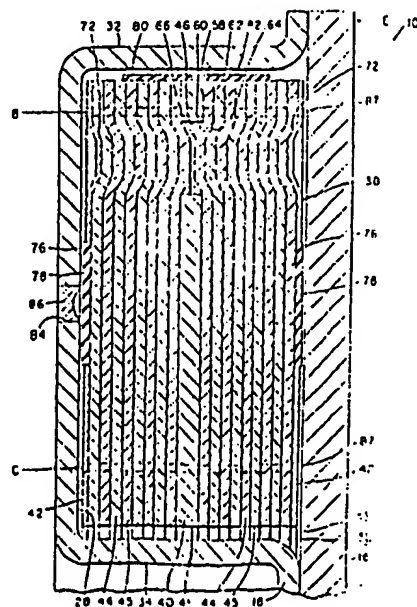
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54 Viscous vibration damper.

57 The disclosure illustrates a viscous vibration damper (10) capable of manufacture using low cost fabrication techniques. Formed and welded steel plates (16,18) form an annular working chamber (36) containing a viscous fluid and an annular inertia ring (38) consisting of series of stacked welded discs (40,42,44). One of the discs (40) has a pair of spaced holes (46,48) at fixed locations relative to its central axis (A). The remaining discs (44) have dimples (66,68) at the same location relative to their central axis. The dimples (66,68) permit the discs to be nested in concentric alignment. The outermost discs (42,44) have holes (76) which provide recesses for nylon bearing pads (78) for the inertia ring (38).

FIG-3



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T I T L E

"VISCOUS VIBRATION DAMPER"

LEN/SJ/94548

The present invention relates to rotary vibration dampers and more specifically to the type of damper known as a viscous vibration damper. 0013122

Vibration dampers of the type shown in U.S. Patent No. 2,824,467 damp torsional vibrations in a rotary output shaft such as the crankshaft of an internal combustion engine. An annular housing is secured to the crankshaft, and has a chamber filled with highly viscous fluid and a heavy ring known as an inertia ring. When the engine is operating and producing torsional vibrations in the crankshaft, the inertia ring tends to oscillate relative to the housing. The relative movement causes a working of the viscous fluid thereby dissipating the vibrational energy in the form of heat.

Such a damper has proven effective in damping torsional vibrations for high horsepower engines. However, it is expensive since the inertia ring must be made from a casting or forging and the housing from another casting. Castings and forgings have continued to escalate in cost. Since they constitute a major part of the damper, they prevent the manufacture of a low cost damper. In the past, some attempts have been made to fabricate various elements of dampers torsional vibration in other than cast form. Examples are U.S. Patents No. 2,092,591 and 1,718,208 which show the inertia ring made from a pair of discs. However, this is not a truly effective construction since it fails to insure adequate axial concentricity between the discs.

The above problems are solved by a vibration damper of the above type where the inertia ring comprises a

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plurality of stacked discs with means for securing the
elements in concentric alignment. In a preferred embodiment
the discs have means for forming a protrusion from one
face at least at two fixed locations relative to the central
5 axis thereof and to each other. An indentation on the
opposite face at the same fixed locations enables the disc
to be nestled in concentric alignment.

The above and other related features of the present
invention will be apparent from a reading of the following
10 description of the disclosure shown in the accompanying
drawings and the novelty thereof pointed out in the appended
claims.

In the drawings:

Figure 1 is an end view of a viscous vibration
15 damper embodying the present invention.

Figure 2 is a sectional view of the vibration
damper of Figure 1 along with a portion of an internal
combustion engine crankshaft to which it may be secured.

Figure 3 is a highly enlarged fragmentary view of
20 the damper of Figure 2.

Referring to Figures 1 and 2, the viscous vibration
damper 10 is adapted to be secured to the nose 12 of a
crankshaft 14 such as one for an internal combustion engine.
To this end the damper 10 comprises first and second discs
25 16 and 18 each having holes 20 which receive screws 22 to
secure the damper 10 to the crankshaft 14. A circular
protrusion 24 pilots the damper 10 by means of a central
opening 26. Disc 18 has an annular trough 28 formed adjacent
its periphery 30. Trough 28 has a generally rectangular

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cross section and has an outer border or wall 32 adjacent
periphery 30 and an inner wall or border 34 intermediate
periphery 30. Disc 16 and formed disc 18 form in cooperation
an annular working chamber 36 which contains an inertia ring
generally indicated at 38 and highly viscous fluid (not
shown) to produce the damping action described above.

Referring to Figure 3, inertia ring 38 comprises
a plurality of stacked discs including a central disc 40,
end discs 42 and intermediate discs 44, having central
holes 41, 43, and 45 respectively. Disc 40, which we will
call a reference disc, has a pair of holes 46, 48, of given
diameter, each positioned in a fixed location with respect
to one another and to the central axis A of the damper 10.
As shown particularly in Figure 1, hole 46 has a distance r_1
from central axis A and hole 48 has a distance r_2 from axis
A. The angular position with respect to one another is
represented by angle θ . As illustrated r_1 is equal to r_2
and the angle θ is 180° . It should be apparent, however,
that r_1 need not be equal to r_2 and that θ can be an angle
other than 180° .

Face 58 of each disc 44 has a protrusion 60 ex-
tending from it and the opposite face 62 has an indentation
64 conforming to and in the same position as protrusion 60.
When the protrusion and indentation are formed integral with
the material of disc 44 a dimple 66 is thus formed. The
dimple 66 is sized and positioned at radius r_1 , with respect
to the axis of disc 4 so that it will be received in hole
46. A corresponding dimple 68 has the size and position at
radius r_2 with respect to the axis of disc 44 and angle θ
with respect to dimple 66 to be received in hole 48. Each

disc 44 has dimples 66 and 68 in the same location so that
when the dimples 66 are nestled the discs 44 are in con-
centric alignment with the reference disc 40. The end discs
42 have dimples 72 and 74 in the same r_1 , r_2 and θ positions
so that they are also nestled in concentric alignment. In
addition, end discs 42 have holes 76 which in cooperation
with adjacent disc 44 form a recess which receives a nylon
pad 78. The thickness of discs 42 are made less than the
thickness of pad 78 so that it protrudes and acts as a
bearing to prevent metal to metal contact between the inertia
ring 38 and the walls of working chamber 36. The discs 40,
44 and 42 are secured, for example, by resistance or electron
beam welding, 87, at radius B and C.

The manufacture of the above damper takes place as
follows. The discs 40, 44 and 42 are formed by a suitable
means such as a punch press to obtain the outer and inner
diameters. Then the dimples 66, 72 are formed as well as
hole 76 punched out. When this is completed the discs are
stacked so that the dimple sets 66, 72 and 68, 74 nestle in
one another, and that the dimples 66, 68 on either side of
the reference disc 40 project into the holes 46 and 48
respectively. Since there is a set of discs on either side
of the reference disc 40, it is desirable to make θ equal to
 180° . In that way a single die can be used to produce the
discs to the right and to the left of reference disc 40.
The dimples and the holes maintain the discs in concentric
alignment so that they may be clamped and then welded to-
gether. If necessary the outer faces of one of the discs 42
may be machined to achieve a given clearance between the end
faces of internal ring 38 and the corresponding walls of
working chamber 36.

When this is completed, the nylon pads 78 are inserted in holes 76 and the periphery of the inertia ring 38 wrapped with teflon tape at 80 and 82. The inertia ring is placed in trough 28 and discs 18 and 16 placed against one another. The discs 16 and 18 are secured together continuously at a radius D adjacent the inner border of the working chamber 36 and a radius E adjacent the outer border for example by electron beam or arc welding. Thus, the working chamber 36 at radiuses E and D is completely sealed. Two holes 84 in disc 18 with removable plugs 86 permits viscous fluid to be forced into working chamber 36. Such fluid may be silicone of an appropriately high viscosity.

Thus, it is seen by the description above that the damper produced has a total lack of cast or forged parts. The stamping and forming needed for this damper are well within the capability of many small fabrication shops. The resultant material cost reduction and simplicity of fabrication enables a substantial reduction in manufactured cost while maintaining an equivalent level of performance.

C L A I M S

1. A viscous vibration damper comprising,
housing means (16,18) for forming an annular working
chamber (36), an annular inertia element (38)
rotatably contained within said working chamber (36),
5 said element (38) comprising a plurality of
stacked disc elements (40,42,44) and means for securing
said elements (40,42,44) together in concentric
alignment and a viscous fluid contained within said
chamber (36) whereby torsional oscillations of said
10 housing means are damped by the working of said
viscous fluid within said chamber (36).

2. Apparatus as in claim 1 wherein said
discs (44) include means for forming a protrusion
(60) extending from one face thereof at at least
15 two locations, and an indentation (64) on the opposite
face thereof at said two locations, said indentations
(64) being placed at substantially identical locations
relative to the central axis and to each other for
all of said discs whereby said protrusions (60) are
20 received in indentations (64) of adjacent discs and
said discs are nestled in concentric alignment.

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3. Apparatus as in claim 2 wherein one of
said discs (40) has indentations on both faces
thereof at said locations to form a reference
disc, the protrusions (60) on the remaining discs
5 (42, 44) facing said reference disc (40) whereby the
end discs of said stack do not have protrusions
extending from said stack.

4. Apparatus as in claim 2 wherein said
protrusion and indentation means comprises
10 dimples (66, 68) formed in said discs.

5. Apparatus as in claim 4 wherein each disc
has a pair of dimples (66, 68) spaced approximately
180° apart.

6. Apparatus as in claim 4 wherein one of said
15 discs (40) has holes (46, 48) therethrough at said
locations to form a reference disc, all of the
dimples (66, 68) facing toward said opening so that
the end discs (42, 44) do not have protrusions
extending from said stack.

7. Apparatus as in claim 6 further comprising
nylon pads (78) for acting as a bearing between the
end faces of said stack of discs and the walls of
said working chamber (36) and wherein the discs (42, 44)

at opposite ends of the stack have holes (76) therethrough whereby in the stack said holes (76) and the face of the adjacent disc form a recess for receiving said nylon pads (78).

5 8. Apparatus as in claim 1 further comprising nylon pads (78) for acting as a bearing between the end faces of said stack of discs and the walls of said working chamber (36) and wherein the discs at
10 opposite ends of the stack have holes (76) therethrough whereby in the stack said holes (76) and the face of the adjacent disc form a recess for receiving said nylon pads.

9. Apparatus as in claim 1 wherein said securing means is an electron beam or resistance weld.

15 10. Apparatus as in claim 1 wherein said housing means comprises: a first annular element (18) formed with an annular trough (28) having a rectangular cross section adjacent its periphery and a flat circular plate element (16) abutting said
20 first element (18) to form therewith said working chamber (36), and means for continuously securing said first and second elements adjacent the inner and outer boundary of said trough (28) to seal said working chamber.



11. Apparatus as in claim 6 wherein said means comprises an electron beam or resistance weld.

12. Apparatus as in claim 6 wherein one of said elements is formed from high strength steel for resisting axially directed vibrations of a rotary member to which the vibration damper is attached.

13. Apparatus as in claim 8 wherein said second element is formed from high strength steel.



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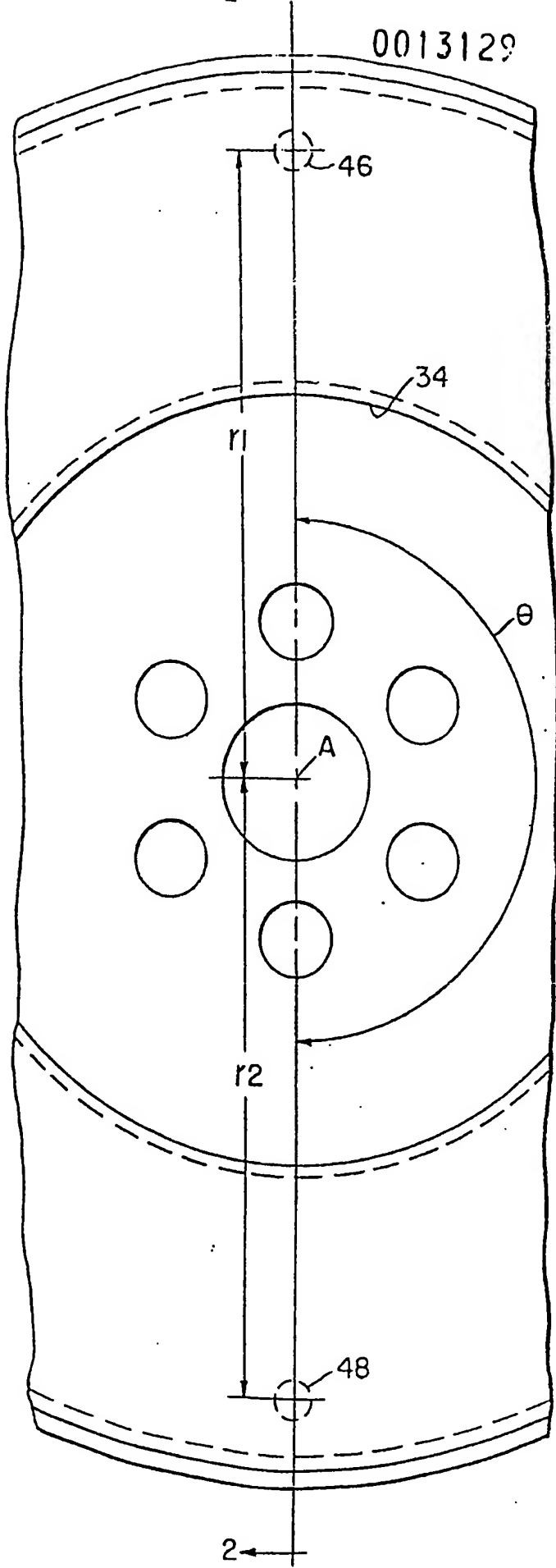
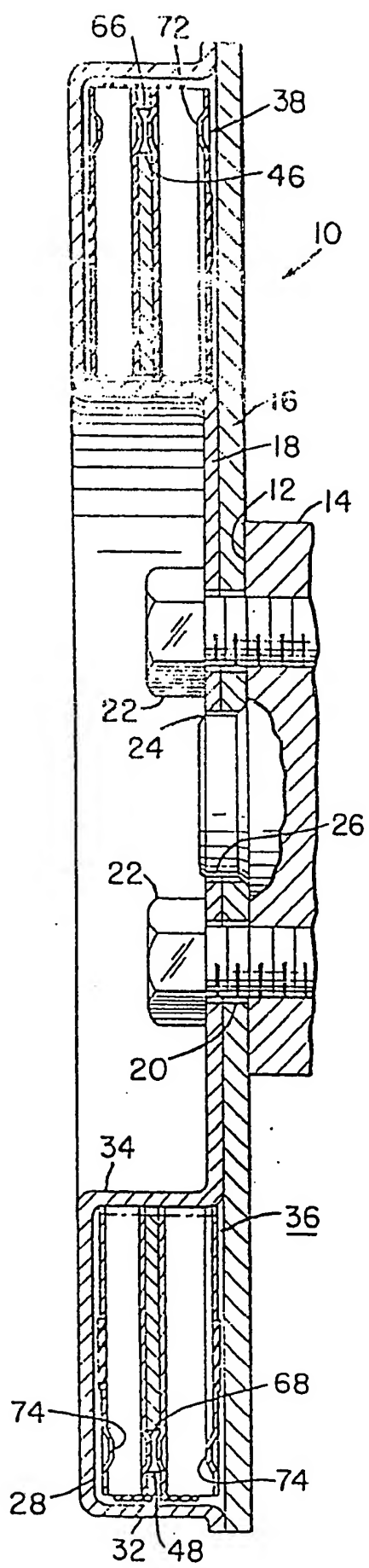
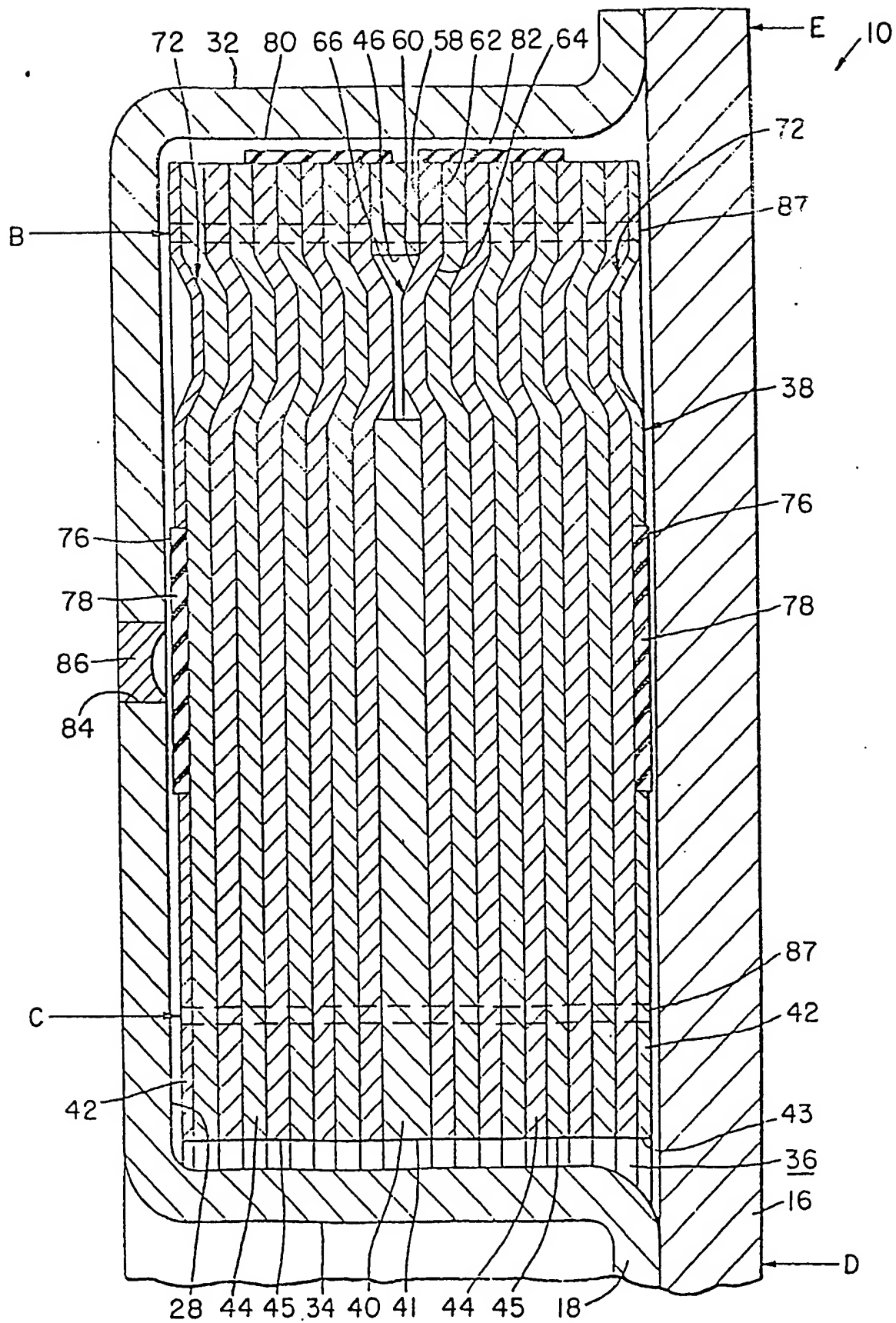


FIG-3

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European Patent
Office

EUROPEAN SEARCH REPORT

0013129
Application number

EP 79 30 2965

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
D	<u>US - A - 2 824 467</u> (O'CONNOR)		F 16 F 15/30 15/16
D	<u>US - A - 2 092 591</u> (SOHLSTROM)		
D	<u>US - A - 1 718 208</u> (ANIBAL)		
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X	<u>GB - A - 1 239 450</u> (HOLSET) * Page 1, lines 75-83; page 2, line 38 to page 3, line 88; page 4, line 116 to page 5, line 92 *	1, 9, 10, 11	
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	<u>GB - A - 1 092 428</u> (O'CONNOR) * Page 3, line 49 to page 8, line 74; figures 1-9 *	1, 7, 8, 10	F 16 F B 24 D
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X	<u>US - A - 1 532 962</u> (TURNER) * Entire document *	1, 2, 4, 5	
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	<u>DE - A - 2 606 577</u> (BARMAG BARMER) * Page 1, claim 1; figures 1a-3 *	1-3	
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	<u>GB - A - 366 818</u> (BRITISH THOMSON HOUSTON CIE) * Entire document *	1, 2	
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	<u>US - A - 3 716 901</u> (BRAGG) * Column 1, line 51 to column 4, line 16; figures 1-6 *	1, 7, 8, 10, 12, 13	
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The present search report has been drawn up for all claims			& member of the same patent family. corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	27-03-1980	ESPEEL	



EUROPEAN SEARCH REPORT.

Application number 0013122

EP 79 30 2965

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EPO Form 1503.2 06.78